

NITRIDE SEMICONDUCTOR WAFER AND METHOD OF PROCESSING NITRIDE SEMICONDUCTOR WAFER

ABSTRACT OF THE DISCLOSURE

Nitride semiconductor wafers which are produced by epitaxially grown nitride films
5 on a foreign undersubstrate in vapor phase have strong inner stress due to misfit between the
nitride and the undersubstrate material. A GaN wafer which has made by piling GaN films
upon a GaAs undersubstrate in vapor phase and eliminating the GaAs undersubstrate bends
upward due to the inner stress owing to the misfit of lattice constants between GaN and GaAs.
Ordinary one-surface polishing having the steps of gluing a wafer with a surface on a flat disc,
10 bringing another surface in contact with a lower turntable, pressing the disc, rotating the disc,
revolving the turntable and whetting the lower surface, cannot remedy the inherent distortion.
The Distortion worsens morphology of epitaxial wafers, lowers yield of via-mask exposure
and invites cracks on surfaces. Nitride crystals are rigid but fragile. Chemical/mechanical
polishing has been requested in vain. Current GaN wafers have roughened bottom surfaces,
15 which induce contamination of particles and fluctuation of thickness.

Circular nitride wafers having a diameter larger than 45mm are made and polished.
Gross-polishing polishes the nitride wafers in a pressureless state with pressure less than
60g/cm² by lifting up the upper turntable for remedying distortion. Distortion height H at a
center is reduced to $H \leq 12\mu\text{m}$. Minute-polishing is a newly-contrived CMP which polishes
20 the nitride wafers with a liquid including potassium hydroxide, potassium peroxodisulfate and
powder, irradiates the potassium peroxodisulfate with ultraviolet rays. The CMP-polished
top surface has roughness RMS of $0.1\text{nm} \leq \text{RMS} \leq 5\text{nm}$ or more favorably $0.1\text{nm} \leq \text{RMS} \leq 0.5\text{nm}$.
The CMP-polished bottom surface has roughness RMS of $0.1\text{nm} \leq \text{RMS} \leq 5000\text{nm}$ or more
favorably $0.1\text{nm} \leq \text{RMS} \leq 2\text{nm}$. TTV is less than $10\mu\text{m}$.